

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

Claims 1-12 (canceled)

Claim 13 (currently amended): A method for the optimization of the production of a genetic end product comprising:

- a) providing a multiplicity of integration cassettes, each cassette comprising:
  - (i) a promoter;
  - (ii) a selectable marker bounded by specific recombinase sites responsive to a recombinase;
  - (iii) regions of homology to different portions of a P1 donor cell chromosome;
- b) transforming at least one donor cell with at least one of the multiplicity of integration cassettes ~~the integration cassette~~ of (a) for its chromosomal integration;
- c) infecting the at least one transformed donor cell of (b) with a P1 phage wherein the phage replicates and the at least one transformed donor cell is lysed;
- d) isolating phage released by the lysis of the at least one transformed donor cell of (c);
- e) mixing equal number of isolated ~~isolating~~ phage released by the lysis of a set of donor cells of (c) carrying different integration cassettes of (a);
- f) infecting at least one ~~[[a]]~~ recipient cell with the mixture of the isolated phage of (e) wherein the integration cassettes each integrate into the at least one recipient cell chromosome at the point of homology to the homology arms;
- g) growing the at least one infected recipient cell of (f) so that a population of transduced recipient cells containing the selectable marker is produced;

- h) selecting transduced recipient cells of (g) on the basis of the selectable marker;
- i) ~~h~~ screening the transduced recipient cells of (h) cell of (f) for the highest level of the genetic end product to identify a first overproducing strain;
- j) ~~i~~ activating a recombinase in the first overproducing ever producing strain of (i) ~~h~~ which excises the selectable marker from the chromosomally integrated integration cassette;
- k) ~~j~~ infecting the first overproducing ever producing strain of (j) ~~i~~ with the mixture of the isolated phage of (e) wherein the integration cassettes each integrate into the first overproducing strain recipient cell chromosome at the point of homology on the homology arms;
- l) growing the first overproducing strain of (k) so that a population of first overproducing strain containing the selectable marker is produced;
- m) selecting first overproducing strain of (l) on the basis of the selectable marker;
- n) ~~k~~ screening the first overproducing ever producing strain of (m) ~~j~~ for the highest level of the genetic end product to identify a second overproducing strain; and
- o) ~~i~~ comparing the levels of genetic end product produced by the first and second overproducing ever producing strains whereby the production of the genetic end product is optimized.

Claim 14 (currently amended): A method according to Claim 13 wherein each promoter is a native promoter of the promoter regions are derived from a cell other than the donor cell or recipient cell.

Claim 15 (original): A method according to Claim 13 wherein the promoter is selected from the group consisting of *lac*, *ara*, *tet*, *trp*,  $\lambda P_L$ ,  $\lambda P_R$ , *T7*, *tac*,  $P_{T5}$ , and *trc*.

Claim 16 (original): A method according to Claim 13 wherein the promoter is  $P_{T5}$ .

Claim 17 (original): A method according to Claim 13 wherein the donor cell and recipient cell have the genes that comprise the isoprenoid biosynthetic pathway.

Claim 18 (original): A method according to Claim 17 wherein the integration cassette integrates into the recipient chromosome so as to operably link the promoter and a gene of the isoprenoid biosynthetic pathway.

Claim 19 (currently amended): A method according to Claim 18 wherein the gene genes of the isoprenoid biosynthetic pathway is are selected from the group consisting of *dxs*, *dxr*, *ygbP*, *ychB*, *ygbB*, *idi*, *ispA*, *lytB*, *gcpE*, *ispA*, *ispB*, *crtE*, *crtY*, *crtl*, *crtB*, *crtX*, *crtW*, *crtO*, *crtR*, and *crtZ*.

Claim 20 (currently amended): A method according to Claim 18 wherein the genetic end product is a carotenoid selected from the group consisting of antheraxanthin, adonixanthin, astaxanthin, canthaxanthin, capsorubrin,  $\beta$ -cryptoxanthin, didehydrolycopene, ~~didehydrolycopene~~,  $\beta$ -carotene,  $\zeta$ -carotene,  $\delta$ -carotene,  $\gamma$ -carotene, keto- $\gamma$ -carotene,  $\psi$ -carotene,  $\epsilon$ -carotene,  $\beta,\psi$ -carotene, torulene, echinenone, ~~gamma carotene~~, ~~zeta carotene~~, alpha-cryptoxanthin, diatoxanthin, 7,8-didehydroastaxanthin, fucoxanthin, fucoxanthinol, isorenieratene,  $\beta$ -isorenieratene, lactucaxanthin, lutein, lycopene, neoxanthin, neurosporene, hydroxyneurosporene, peridinin, phytoene, rhodopin, rhodopin glucoside, siphonaxanthin, spheroidene, spheroidenone, spirilloxanthin, uriolide, uriolide acetate, violaxanthin, zeaxanthin- $\beta$ -diglucoside, zeaxanthin, and C30-carotenoids.